Remarks/Arguments

The Applicants have considered the non-final Office action dated April 5, 2011, and submit this response.

Claim Rejections - 35 USC §103

The Examiner is rejecting claims 1-2, 6-7, 15-24, and 26-28 under 35 U.S.C. § 103(a) as being unpatentable over Shoji et al. (JACS 2002, 124, 12486-12493) in view of Mattoso et al. (Synthetic Metals, 68 (1994), 1-11). The Examiner is similarly rejecting claims 1-2, 6-7, 15-24, and 26-28 as being unpatentable over Freund et al. (U.S. publication no. 2002/0029979) in view of Mattoso. For each grounds of rejection, which the Applicants address in turn below, the Examiner has failed to make a prima facie case of obviousness. Consequently, for the reasons discussed in detail below, the Applicants respectfully request withdrawal of these rejections.

Rejection Under 35 U.S.C. § 103(a) based on Shoji et al. in view of Mattoso et al.

The Examiner rejected Claims 1-2, 6-7, 15-24 and 26-28 as being unpatentable over Shoji et al. (JACS 2002, 124, 12486-12493) in view of Mattoso et al. (Synthetic Metals, 68 (1994), 1-11). Applicants submit that the Shoji et al. and Mattoso et al. references fail to satisfy the requirements for a finding of obviousness of independent Claim 1 and independent Claim 6.

Applicants' submissions in this respect have been prepared in light of the "Examination Guidelines for Determining Obviousness Under 35 U.S.C. § 103 in view of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.*" (Federal Register, Vol. 72, No. 195, Oct. 10, 2007, pp. 57526 - 57535) (the "Guidelines").

In *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 at 17-18 (1966), the Supreme Court set out the following objective framework for applying the statutory language of §103:

> Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long

> felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

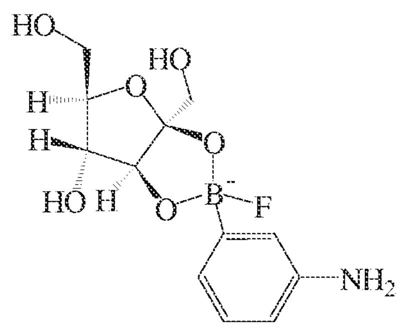
Accordingly, the Guidelines confirm that obviousness is a question of law based on underlying factual inquiries. The factual inquiries enunciated by the Court in *Graham* are as follows:

> (1) Determining the scope and content of the prior art;
>
> (2) Ascertaining the differences between the claimed invention and the prior art; and
>
> (3) Resolving the level of ordinary skill in the pertinent art.

Independent Claim 1 recites: A conductive boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form, wherein conversion between the water-insoluble non-self-doped form and the water-soluble self-doped form is by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride, and wherein the polyaniline polymer has a molecular weight of at least 100,000.

Independent Claim 6 recites: A polyaniline polymer capable of converting in solution between:

a water-soluble self-doped form comprising repeating units as shown below:



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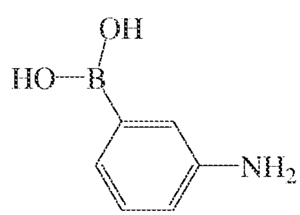
; and

a water-insoluble non-self-doped form comprising repeating units as shown below:



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wherein the polyaniline polymer has a molecular weight of at least 100,000, and wherein the water-soluble form is converted in solution to the water-insoluble form by reducing fluoride and/or fructose concentration of the polymer solution and the water-insoluble form is converted to the water-soluble form by increasing fluoride and/or fructose concentration of the polymer solution.

Applicants respectfully submit that Shoji et al. does not

teach or suggest a conductive poly(3-aminophenylboronic acid) capable of converting between a water-soluble self-doped form and a water-insoluble non-self doped form by a reversible chemical reaction by exposing poly(3-aminophenylboronic acid) in D-fructose in PBS as suggested by the Examiner. Applicants respectfully disagree with the Examiner's finding, namely that although Shoji et al. and Mattoso et al. are silent on the reversible reactions between boronic acid of the polyaniline with D-fructose in the presence of fluoride, this limitation is construed as part of an inherent property. In addition, Applicants disagree with the Examiner's finding, namely that one of ordinary skill in the art would have expected the process (and the resulting product) disclosed by Shoji et al. and Mattoso et al. to feature the same hardness and other property because they obviously satisfy all of the material and chemical limitations of the instant invention. The conductive boronic acid substituted polyaniline polymer of the present application is prepared by oxidative polymerization of a monomer using an oxidant in the presence of a saccharide and fluoride. The polymer is soluble under the polymerization conditions of the present application, and thus polymerization of the monomer occurs in a bulk homogeneous solution. Since the polymer is soluble under the polymerization conditions, the polymerization

reaction is not expected to suffer from precipitation induced effective termination, and thus the polymerization procedure of the present application results in polymer having a molecular weight of at least 100,000. In contrast to the present application, a poly(aniline boronic acid) taught by Shoji et al. is prepared by electrochemical polymerization of monomer in the presence of fluoride where polymerization is induced by application of a potential to an electrode and the polymer is deposited in the form of a film on the electrode. Poly(aniline boronic acid) is not soluble under the polymerization conditions taught by Shoji et al. and the polymerization does not occur in a bulk homogeneous solution. Poly(aniline boronic acid) prepared by the procedure taught by Shoji et al. has different solubility properties than the solubility properties of the boronic acid substituted polyaniline polymer recited in Claims 1 and 6, namely the poly(aniline boronic acid) prepared by the procedure taught by Shoji et al. would not have been expected to exhibit sufficient solubility. Thus, one of ordinary skill in the art would not have expected the poly(aniline boronic acid) taught by Shoji et al. to be capable of converting between a water-soluble self-doped form and a water-insoluble non-self doped form by a reversible chemical reaction comprising complexation between boronic acid with a saccharide in the

presence of fluoride. In support of Applicants' submissions, Applicants provide Freund Declaration submitted herewith. In addition, poly(aniline boronic acid) prepared by the procedure taught by Shoji et al. would not be expected to have a molecular weight of at least 100,000.

On page 7 of the Office action, the Examiner states as follows:

> The MW is further increased by lowering the reaction temperature even LiF is used. One of Mottoso's objectives is to increase the MW via using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, and using LiF, NaCl, CaCl2, and LiNO3 increases the MW of polymer produced. MW to 156k or 160k is achieved by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization (Fg. 1, col. 1-2).

Applicants submit that the combination of teachings of Shoji et al. and Mattoso et al., namely the modification of the poly(aniline boronic acid) of Shoji et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant in the polymerization procedure, would not have resulted in the preparation of a boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form that has a molecular weight of at least 100,000. Applicants submit that modification of the poly(aniline boronic

acid) of Shoji et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant and using LiF, NaCl, $CaCl_2$ and $LiNO_3$ in the polymerization procedure, would also not have resulted in the preparation of a boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form that has a molecular weight of at least 100,000. In addition, Applicants submit that modification of the poly(aniline boronic acid) of Shoji et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant, using LiF, NaCl, $CaCl_2$ and $LiNO_3$ in the polymerization procedure, and lowering the reaction temperature, would not have resulted in the preparation of a boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form that has a molecular weight of at least 100,000. Modification of the poly(aniline boronic acid) of Shoji et al. using the above-mentioned conditions would not have resulted in a polymer that is soluble under the polymerization conditions. One of ordinary skill in the art would have expected the polymer to be insoluble and would have expected precipitation of the polymer to result in effective termination of polymerization producing a poly(aniline boronic acid) having a molecular weight

of less than 100,000. In support of Applicants' submissions, Applicants provide Freund Declaration submitted herewith.

Applicants further submit that it would not have been obvious to one of ordinary skill in the art to have modified poly(aniline boronic acid) disclosed by Shoji et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant in the polymerization procedure. Poly(aniline boronic acid) taught by Shoji et al. is used as a sensor in the potentiometric detection of saccharides. The polymerization procedure taught by Shoji et al. produces a conducting poly(aniline boronic acid) in the form of a film deposited on an electrode which could be used as a sensor. One of ordinary skill in the art would have expected a polymerization procedure using an oxidant to produce a polymer that is insoluble under the polymerization conditions and that would have required further processing steps to be realized and undertaken to put the polymer in a form suitable for use as a sensor.

Applicants respectfully submit that the combined teachings of Shoji et al. and Mattoso et al. fail to teach or suggest a polymerization process using an oxidant and reacting a monomer in the presence of a saccharide and fluoride. Indeed, there is no teaching in Shoji et al. and Mattoso et al. of using a saccharide as a reagent during the polymerization process.

In view of the foregoing, Applicants submit that Claim 1 is not unpatentable over Shoji et al. in view of Mattoso et al. Claims 2, 15, 16, 17, 18, 19, 20, and 27 depend directly or indirectly on amended Claim 1. Accordingly, withdrawal of the rejection of Claims 2, 15, 16, 17, 18, 19, 20, and 27 based on Shoji et al. in view of Mattoso et al. is respectfully requested. Applicants also submit that Claim 6 is not unpatentable over Shoji et al. in view of Matttoso et al. Claims 7, 21, 22, 23, 24, 26, and 28 depend directly or indirectly on Claim 6. Accordingly, withdrawal of the rejection of Claims 7, 21, 22, 23, 24, 26, and 28 based on Shoji et al. in view of Mattoso et al. is respectfully requested.

Rejection Under 35 U.S.C. § 103(a) based on Freund et al. in view of Mattoso et al.

The Examiner rejected Claims 1-2, 6-7, 15-24, and 26-28 as being unpatentable over Freund et al. (US 2002/0029979) in view of Mattoso et al. (Synthetic Metals, 68 (1994), 1-11). Applicants submit that the Freund et al. and Mattoso et al. references fail to satisfy the requirements for a finding of obviousness of independent Claim 1 and independent Claim 6.

As discussed above, the Guidelines confirm that obviousness

is a question of law based on underlying factual inquiries. The factual inquiries enunciated by the Court in *Graham* are as follows:

(1) Determining the scope and content of the prior art;

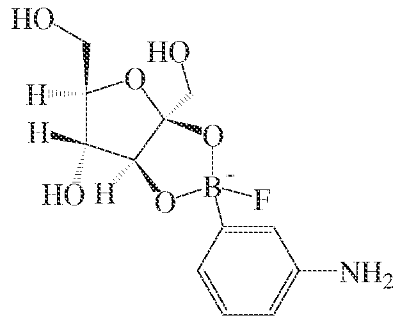
(2) Ascertaining the differences between the claimed invention and the prior art; and

(3) Resolving the level of ordinary skill in the pertinent art.

Independent Claim 1 recites: A conductive boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form, wherein conversion between the water-insoluble non-self-doped form and the water-soluble self-doped form is by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride, and wherein the polyaniline polymer has a molecular weight of at least 100,000.

Independent Claim 6 recites: A polyaniline polymer capable of converting in solution between:

a water-soluble self-doped form comprising repeating units as shown below:



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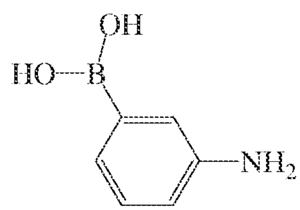
; and

a water-insoluble non-self-doped form comprising repeating units as shown below:



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wherein the polyaniline polymer has a molecular weight of at least 100,000, and wherein the water-soluble form is converted in solution to the water-insoluble form by reducing fluoride and/or fructose concentration of the polymer solution and the water-insoluble form is converted to the water-soluble form by increasing fluoride and/or fructose concentration of the polymer solution.

Applicants respectfully submit that Freund et al. does not teach or suggest a conductive poly(3-aminophenylboronic acid) capable of converting between a water-soluble self-doped form

and a water-insoluble non-self doped form by a reversible chemical reaction by exposing poly(3-aminophenylboronic acid) in D-fructose in PBS as suggested by the Examiner. Applicants also respectfully disagree with the Examiner's finding, namely that although Freund et al. and Mattoso et al. are silent on the reversible reactions between boronic acid of the polyaniline with D-fructose in the presence of fluoride, this limitation is construed as part of an inherent property. In addition, Applicants disagree with the Examiner's finding, namely that one of ordinary skill in the art would have expected the process (and the resulting product) disclosed by Freund et al. and Mattoso et al. to feature the same hardness and other property because they obviously satisfy all of the material and chemical limitations of the instant invention. The conductive boronic acid substituted polyaniline polymer of the present application is prepared by oxidative polymerization of a monomer using an oxidant in the presence of a saccharide and fluoride. The polymer is soluble under the polymerization conditions of the present application, and thus polymerization of the monomer occurs in a bulk homogeneous solution. Since the polymer is soluble under the polymerization conditions, the polymerization reaction is not expected to suffer from precipitation induced effective termination, and thus the polymerization reaction of

the present application results in polymer having a molecular weight of at least 100,000. In contrast to the present application, poly(aniline boronic acid) taught by Freund et al. is prepared by electrochemical polymerization of monomer in the presence of fluoride and Nafion where polymerization is induced by application of a potential to an electrode and the polymer is deposited in the form of a film on the electrode. Poly(aniline boronic acid) is not soluble under the polymerization conditions taught by Freund et al. and the polymerization does not occur in a bulk homogeneous solution. Poly(aniline boronic acid) prepared by the procedure taught by Freund et al. has different solubility properties than the solubility properties of the boronic acid substituted polyaniline polymer recited in Claims 1 and 6, namely the poly(aniline boronic acid) prepared by the procedure taught by Freund et al. would not have been expected to exhibit sufficient solubility. Thus, one of ordinary skill in the art would not have expected the poly(aniline boronic acid) taught by Freund et al. to be capable of converting between a water-soluble self-doped form and a water-insoluble non-self doped form by a reversible chemical reaction comprising complexation between boronic acid with a saccharide in the presence of fluoride. In support of Applicants' submissions, Applicants provide Freund Declaration submitted herewith. In

addition, poly(aniline boronic acid) prepared by the procedure taught by Freund et al. would not have been expected to have a molecular weight of at least 100,000.

On pages 8 and 9 of the Office action, the Examiner states as follows:

> The MW is further increased by lowering the reaction temperature even LiF is used. One of Mottoso's objectives is to increase the MW via using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, and using LiF, NaCl, CaCl2, and LiNO3 increases the MW of polymer produced. MW to 156k or 160k is achieved by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization (Pg. 1, col. 1-2). In light of this,

Applicants submit that the combination of teachings of Freund et al. and Mattoso et al., namely the modification of the poly(aniline boronic acid) of Freund et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant in the polymerization procedure, would not have resulted in the preparation of the boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form that has a molecular weight of at least 100,000. Applicants submit that the modification of the poly(aniline boronic acid) of Freund et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant and using LiF, NaCl,

$CaCl_2$ and $LiNO_3$ in the polymerization procedure, would not have resulted in the preparation of the boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form that has a molecular weight of at least 100,000. Furthermore, Applicants submit that the modification of the poly(aniline boronic acid) of Freund et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant, using LiF, NaCl, $CaCl_2$ and $LiNO_3$ in the polymerization procedure, and lowering the reaction temperature, would not have resulted in the preparation of the boronic acid substituted polyaniline polymer capable of converting in solution between a water-soluble self-doped form and a water-insoluble non-self doped form that has a molecular weight of at least 100,000. Modification of the poly(aniline boronic acid) of Freund et al. using the above-mentioned conditions would not have resulted in a polymer that is soluble under the polymerization conditions. One of ordinary skill in the art would have expected the polymer to be insoluble and effective termination of polymerization resulting from precipitation of the polymer would have been expected producing a poly(aniline boronic acid) having a molecular weight of less than 100,000. In support of Applicants' submissions, Applicants provide Freund Declaration

submitted herewith.

Applicants further submit that it would not have been obvious to one of ordinary skill in the art to have modified poly(aniline boronic acid) disclosed by Freund et al. by using polyvinylsulfonic acid or ammonium peroxydisulphate as an oxidant in the polymerization procedure. Poly(aniline boronic acid) taught by Freund et al. is used as a sensor in the potentiometric detection of saccharides. The polymerization procedure taught by Freund et al. produces a conducting poly(aniline boronic acid) in the form of a film deposited on an electrode which could be used as a sensor. One of ordinary skill in the art would have expected a polymerization procedure using an oxidant to produce a polymer that is insoluble under the polymerization conditions and that would have required further processing steps to be realized and undertaken to put the polymer in a form suitable for use as a sensor.

Applicants respectfully submit that the combined teachings of Freund et al. and Mattoso et al. fail to teach or suggest a polymerization process using an oxidant and reacting a monomer in the presence of a saccharide and fluoride. There is no teaching in Freund et al. and Mattoso et al. of using a saccharide as a reagent during the polymerization process.

In view of the foregoing, Applicants submit that amended Claim 1 is not unpatentable over Freund et al. in view of Mattoso et al. Claims 2, 15, 16, 17, 18, 19, 20, and 27 depend directly or indirectly on Claim 1. Accordingly, withdrawal of the rejection of Claims 2, 15, 16, 17, 18, 19, 20, and 27 based on Freund et al. in view of Mattoso et al. is respectfully requested. Applicants submit that Claim 6 is not unpatentable over Freund et al. in view of Mattoso et al. Claims 7, 21, 22, 23, 24, 26, and 28 depend directly or indirectly on Claim 6. Accordingly, withdrawal of the rejection of Claims 7, 21, 22, 23, 24, 26, and 28 based on Freund et al. in view of Mattoso et al. is respectfully requested.

In close, the Applicants respectfully request reconsideration of the rejections set forth in the Office action and hereby solicit favorable consideration and allowance of the claims. Should the Examiner have any questions regarding this response or the allowability of the claims, the Applicants would appreciate if the Examiner would contact the undersigned attorney of record at the telephone number provided below for purposes of facilitating prosecution of this application.

Respectfully submitted,

DOWELL & DOWELL, P.C.

By /Alyssa Ann Finamore/
Alyssa Ann Finamore
Reg. No. 55,177
Date: October 5, 2011

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